BRNO UNIVERSITY OF TECHNOLOGY

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

FACULTY OF CIVIL ENGINEERING

FAKULTA STAVEBNÍ

INSTITUTE OF BUILDING STRUCTURES

ÚSTAV POZEMNÍHO STAVITELSTVÍ

DETACHED HOUSE

RODINNÝ DŮM

BACHELOR'S THESIS

BAKALÁŘSKÁ PRÁCE

AUTHOR — Nour Kováčová

AUTOR PRÁCE

SUPERVISOR — prof. Ing. JITKA MOHELNÍKOVÁ, Ph.D.

VEDOUCÍ PRÁCE

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Studijní program	B3607 Civil Engineering
Typ studijního programu	Bakalářský studijní program v anglickém jazyce a prezenční formou studia
Studijní obor	3608R001 Pozemní stavby
Pracoviště	Ústav pozemního stavitelství

ZADÁNÍ BAKALÁŘSKÉ PRÁCE

Student	Nour Kováčová
Název	Detached House
Vedoucí práce	prof. Ing. Jitka Mohelníková, Ph.D.
Datum zadání	30. 11. 2019
Datum odevzdání	22. 5. 2020

V Brně dne 30. 11. 2019

prof. Ing. Miloslav Novotný, CSc.
Vedoucí ústavu

prof. Ing. Miroslav Bajer, CSc.
Děkan Fakulty stavební VUT

PODKLADY A LITERATURA

(1) Směrnice děkana č. 19/2011 s dodatky a přílohami; (2) Stavební zákon č. 183/2006 Sb. v platném a účinném znění; (3) Vyhláška č. 499/2006 Sb. v platném a účinném znění; (4) Vyhláška č. 268/2009 Sb. v platném a účinném znění; (5) Vyhláška č. 398/2009 Sb.; (6) Platné normy ČSN, EN; (7) Katalogy stavebních materiálů, konstrukčních systémů, stavebních výrobků; (8) Odborná literatura; (9) Vlastní dispoziční řešení budovy a (10) Architektonický návrh budovy.

ZÁSADY PRO VYPRACOVÁNÍ

Zadání: Zpracování určené části projektové dokumentace pro provádění stavby zadané budovy s téměř nulovou spotřebou energie. Cíle: Vyřešení dispozice budovy s návrhem vhodné konstrukční soustavy a nosného systému na základě zvolených materiálů a konstrukčních prvků, včetně vyřešení osazení objektu do terénu s respektováním okolní zástavby. Dokumentace bude v souladu s vyhláškou č. 499/2006 Sb. v platném a účinném znění a bude obsahovat část A, část B, část C a část D v rozsahu části D.1.1 a D.1.3. Dále bude obsahovat studie obsahující předběžné návrhy budovy, návrhy dispozičního řešení a přílohovou část obsahující předběžné návrhy základů a rozměrů nosných prvků a prostorovou vizualizaci budovy včetně modulového schéma budovy. Výkresová část bude obsahovat výkresy situací, základů, půdorysů podlaží, konstrukce zastřešení, svislých řezů, technických pohledů, min. 5 konstrukčních detailů, výkres(y) sestavy dílců, popř. výkres(y) tvaru stropní konstrukce vybraných podlaží. Součástí dokumentace budou i dokumenty podrobností dle D.1.1. bod c), stavebně fyzikální posouzení objektu a vybraných detailů, popř. další specializované části, budou-li zadány vedoucím práce. V rámci stavebně fyzikálního posouzení objektu budou uvedeny údaje o splnění požadavků stavebního řešení pro budovy s téměř nulovou spotřebou energie. Dokumentace bude dále obsahovat koncepci větrání, vytápění a ohřevu vody. Výstupy: VŠKP bude členěna v souladu se směrnicí děkana č. 19/2011 a jejím dodatkem a přílohami. Jednotlivé části dokumentace budou vloženy do složek s klopami formátu A4 opatřených popisovým polem a s uvedením obsahu na vnitřní straně každé složky. Všechny části dokumentace budou zpracovány s využitím PC v textovém a grafickém CAD editoru. Výkresy budou opatřeny popisovým polem. Textová část bude obsahovat i položky h) "Úvod", i) "Vlastní text práce" jejímž obsahem budou průvodní a souhrnná technická zpráva a technická zpráva pro provádění stavby podle vyhlášky č. 499/2006 Sb. v platném a účinném znění a j) "Závěr". V souhrnné technické zprávě a ve stavebně fyzikálním posouzení objektu budou uvedeny použité zásady návrhu budovy s téměř nulovou spotřebou energie. Součástí elektronické verze VŠKP bude i poster formátu B1 s údaji o objektu a jeho grafickou vizualizací.

STRUKTURA BAKALÁŘSKÉ PRÁCE

VŠKP vypracujte a rozčleňte podle dále uvedené struktury:

1. Textová část závěrečné práce zpracovaná podle platné Směrnice VUT "Úprava, odevzdávání a zveřejňování závěrečných prací" a platné Směrnice děkana "Úprava, odevzdávání a zveřejňování závěrečných prací na FAST VUT" (povinná součást závěrečné práce).
2. Přílohy textové části závěrečné práce zpracované podle platné Směrnice VUT "Úprava, odevzdávání, a zveřejňování závěrečných prací" a platné Směrnice děkana "Úprava, odevzdávání a zveřejňování závěrečných prací na FAST VUT" (nepovinná součást závěrečné práce v případě, že přílohy nejsou součástí textové části závěrečné práce, ale textovou část doplňují).

prof. Ing. Jitka Mohelníková, Ph.D.
Vedoucí bakalářské práce

ABSTRACT

The subject of this bachelor thesis is the project documentation and design of a new detached house with almost zero energy consumption. The house is designed for six family members with a translation office for one of the family members. It is located in a quiet part of village Jinačovice, in Brno district in the South Moravian Region of the Czech Republic. This object is detached with two floors, two balconies and big surrounding garden. The vertical load bearing structure of the house is masonry made of ceramic blocks Porotherm. The horizontal load bearing structure is made of prestressed Spiroll ceiling panels. The building is constructed on concrete strip foundations and the top of the building is a flat roof with rainwater outlets and insulation of mineral wool. The building is insulated using ETICS system.

The project documentation also includes a fire safety assessment of the building, foundation and load calculations, a technical thermal and heat loss assessment and an assessment of acoustics and daylighting.

KEYWORDS

Detached house, masonry, Porotherm, prestressed Spiroll ceiling panels, ETICS system, flat roof, balcony, roof outlets, foundation strips.

ABSTRAKT

Předmětem této bakalářské práce je projektová dokumentace a návrh nového rodinného domu s téměř nulovou spotřebou energie. Dům je určen pro šest členů rodiny s překladatelskou kanceláří pro jednoho z členů rodiny. Dům se nachází v klidné části obce Jinačovice, v okrese Brno v Jihomoravském kraji České republiky. Tento objekt je samostatně stojící se dvěma patry, dvěma balkony a velkou okolní zahradou. Svislá nosná konstrukce domu je zděná z keramických tvárnic Porotherm. Vodorovná nosná konstrukce je vyrobena z předpjatých stropních panelů Spiroll. Budova je postavena na základech ze betonových pásů. Střecha je plochá se střešními deštovými vpustmi a izolací z minerální vlny. Budova je zateplena systémem ETICS.

Projektová dokumentace obsahuje také posouzení požární bezpečnosti budovy, výpočty základů a zatížení, tepelně technické posouzení a posouzení na akustiku a denní osvětlení.

KLÍČOVÁ SLOVA

Rodinný dům, zdivo, Porotherm, předpjaté stropní panely Spiroll, systém ETICS, plochá střecha, balkon, střešní vpusti, základové pásy.

BIBLIOGRAPHIC CITATION

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DECLARATION OF CONFORMITY OF THE PRINTED AND ELECTRONIC FORM OF THE FINAL THESIS

I declare that the electronic form of the submitted bachelor's thesis titled *Detached House* is identical to the submitted printed form.

Brno, 14. 5. 2020

Nour Kováčová

author

DECLARATION OF AUTHORSHIP OF THE FINAL THESIS

I, Nour Kováčová declare that this bachelor's thesis titled *Detached House* is my own work and the result of my own original research. I have clearly indicated the presence of quoted or paraphrased material and provided references for all sources.

Brno, 14. 5. 2020

Nour Kováčová

author

THANKS

I would like to thank my supervisor, prof.Ing.Jitka Mohelníková, Ph.D., for her professional guidance, comments and a lot of valuable advices she gave me during my Bachelor Thesis. I would also like to thank my loving husband, who supported me during all my study.

Brno, 22. 5. 2020

Nour Kováčová

Author

Content

1. INTRODUCTION

The aim of my bachelor thesis is to prepare project documentation of a detached house with nearly zero energy consumption. The house is designed for six family members with a translation office for one of the family members.

The house is located in village Jinačovice in Brno district in the south Moravian region of the Czech Republic. It's surrounded by gardens, agricultural fields and other houses. The building is detached and has two floors, with two balconies. The first floor is at ground floor level and the second floor is above ground level.

The object is located 8,7 meters from the main road, which is at the north border of the parcel. So there is a paved walkway in the parcel that leads directly from entrance gate to entrance door of the house.

Parking place is made of timber carport, it is separated from the building and located in the north east corner of the parcel directly near the main road, and it's enough for two cars.

The vertical load bearing structure is masonry made of Porotherm blocks. The horizontal load bearing structure is made of prestressed spiroll ceiling panels. The roof is a flat one with two rain outlets and insulation of mineral wool. The house is insulated using ETICS system with expanded polystyrene and extruded polystyrene as the thermal insulating materials. The building is constructed on concrete strip foundations.

The project documentation includes a fire safety assessment of the building, foundation and load calculations, a technical thermal and heat loss assessment and an assessment of acoustics and daylighting.

When I was working on this thesis I tried to comply with all standards, decrees and laws. Project documentation is divided into eight parts: main text work, preparatory and study work, situation drawings, architectural structural solution, building construction solution, fire safety solution, calculations and building physics, visualization. I used AutoCAD and ArchiCAD software for drawings, I also used Microsoft word, excel and Velux daylight visualizer.

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A. ACCOMPANYING REPORT

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2. MAIN TEXT WORK

A. ACCOMPANYING REPORT

A.1 Identification data

A.1.1 Construction data

a) Name of the construction:

Detached House

b) Place of construction:

Address: Jinačovice, Brno-Country District in the South Moravian Region of the Czech Republic

Cadastral region Jinačovice[660272]

Number of parcel: 110 , postcode: 664 34

c) Subject of the project documentation:

New detached house

A.1.2 Details of the builder

Name, surname and address of permanent residence:

Nour Kováčová

Address: Fanderlíkova 9, 616 00 Brno- Žabovřesky

A.1.3 Details of the project documentation processor

Nour Kováčová, Fanderlíkova 9, 616 00 Brno - Žabovřesky

A.2 Structure division into buildings and technical and technological equipment

- SO 01 – detached house with translation office
- SO 02 and SO 05 – pavement with concrete tiles as a finishing surface
- SO 03 – paved area for garbage bins
- SO 04 – parking area with timber carport

- SO 06 – swimming pool
- SO 07 – wooden fence
- IO 01 – water supply connection
- IO 02 - sanitary drainage connection
- IO 03 – NTL-gas system connection
- IO 04 – electricity connection
- IO 05 – communication connection
- IO 06 – rainwater drainage connection

A.3 List of input documents

- Cadastral map of the parcel and its surrounding
- Google map
- urban planning map

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B. SUMMARY TECHNICAL REPORT

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B. SUMMARY TECHNICAL REPORT

B.1 Description of the construction site

a) Characteristics of the area and building land, built-up area and un-built-up area, compliance of the proposed building with the character of the area, previous use and built-up area

Building land on which the construction of a detached house is planed is located in Jinačovice village in the cadastral region Jinačovice[660272].

The parcel with number 110 is located in the north part of the village, with total area of 1256 m^2. It has access from the north side. The parcel is situated on a slightly sloped terrain to the southwest.

On the north border of the parcel is located HUP and switchboard from which connections to the building will be established. Sanitary drainage, water supply, and communication connections will be also established.

b) Information on compliance with the zoning decision or regulatory plan or public contract by zoning decision replacing or zoning consent

According to the urban plan the parcel is supposed to be a garden so the construction does not comply with the urban plan, so an application for an exemption to build a house must be submitted.

c) Data on compliance with the land-use planning documentation, in the case of construction modifications conditional on a change in the use of the construction

According to the land-use planning document the parcel is specified to be a garden so the construction is not in accordance with the land-use planning. That's why an application for an exemption to build a house must be submitted.

d) Information on decisions taken to grant exemptions from the general requirements for land use

Decision is not yet taken.

e) Information about whether and in what parts of the documentation the conditions of binding opinions of the authorities are taken into account

Conditions have not been set, it is not the subject of the bachelor thesis.

f) Enumeration and conclusions of conducted surveys and analyses - geological survey, hydrogeological survey, construction-historical survey, etc..

In the frame of bachelor thesis no surveys were carried out on the building plot. Project documentation was based on the soil around the village, which is coarse-grained soil of gravel and sand mainly.

g) Protection of the territory under other legal regulations

There are no other legal regulations for protection of the territory.

h) Location with respect to the flood plain, undermined area, etc.

The land is not located in flood nor undermined areas.

i) The impact of the construction on the surrounding buildings and land, the protection of the surroundings, the impact of the construction on the runoff conditions in the territory

The construction will not have a negative impact on the surrounding buildings, it meets the requirements for mutual distances of buildings. All rainwater falling on the roof of the building will be drained to the combined drainage system, so the drainage conditions in the area will not be affected by the construction.

j) Requirements for sanitation, demolition, tree felling

There is no need for sanitation, demolition or felling of trees.

k) Requirements for maximum temporary and permanent occupation of agricultural land fund or land intended for forest function

According to the land-use planning document the parcel is specified to be a garden so the construction is not in accordance with the land-use planning. That's why an application for an exemption to build a house must be submitted.

l) Territorial technical conditions - especially the possibility of connection to the existing transport and technical infrastructure, the possibility of barrier-free access to the proposed construction

The new detached house will be connected to engineering networks. A low-pressure gas connection, electricity and communication connections will be led to the north side of the building, specifically to the kitchen.

Water supply connection will be led to the south west side of the building, specifically to the technical and laundry room. Sanitary drainage connection will be led to the north side of the house.

From the main entrance door of the house there will be a paved walkway that will lead through the garden of the house to the public sidewalk out of the parcel.

Family house is not designed as barrier-free.

m) Material and time constraints of the construction, conditional, induced, related investments

There will be no time nor material constraints. The construction is not related to conditional, induced, neither related investments.

n) List of plots according to the cadastre of real estate on which the construction is carried out.

Parcel number 110, Jinačovice.

o) List of plots by cadastre on which a protection or security zone is established

For the neighbouring parcels number 106/2, Jinačovice

and parcel number 108, Jinačovice, there will be protection zones for the water and sanitary drainage connection.

B.2 Total description of construction

B.2.1 Basic characteristics of construction and its use

a) New construction or modification of the complete construction; in the case of a change of construction, information on their current state, conclusions of the construction-technical or construction-historical survey and the results of the static assessment of load-bearing structures.

It's a new detached house

b) The purpose of the use of the construction

construction for living of a family.

c) Permanent or temporary construction

permanent construction.

d) Information on issued decisions granting exemption from technical requirements for construction works and technical requirements ensuring barrier-free use of the construction

No exemptions were issued for the subject.

e) Information on whether and in what parts of the documentation the conditions of binding opinions of the authorities concerned are taken into account.

It's not a part of the bachelor thesis.

f) Protection of construction according to other legal regulations

Protection of the construction according to other legal regulations is not ordered. The object is not in any protection zones, flood zones nor protected area.

g) Proposed parameters of the construction, built-up area, enclosed space, usable area, number of functional units and their size, etc..

Total parcel area: 1 256 m^2

Built-up area: 128,691 m^2

Enclosed space: 867,456 m^3

Usable area: 197,88 m^2

Number of functional units: 1

Number of house users: 6

Number of business users: 1

h) Basic balance of construction - needs and consumption of media and materials, rainwater management, total amount produced and types of waste and emissions, energy performance class of buildings, etc.

- **Water needs balance**

Specific water demand Q_s for the house

$Q_s = q_r / d$

$Q_s = 35/350 = 0,1\ m^3$/ person × day = 100 l / person × day

q_r - indicative number of annual water demand according to Decree No. 120/2011 Coll. For living unit per inhabitant of the house with running hot water is 35 m^3 per year

d - number of operating days per year (365 days - 15 days of holiday)

Average daily water demand Q_d:

$Q_d = Q_s \times n$

n – number of inhabitants

$Q_d = 0,1 \times 6 = 0,6\ m^3$/ day = 600 l / day

Maximum daily water demand Q_m:

$Q_m = Q_d \times k_d$

$Q_m = 0,6 \times 1,5 = 0,9\ m^3$/ day = 900 l / day

k_d - daily unevenness coefficient (k_d = 1,25 - 1,5)

Maximum hourly water demand Q_h:

$Q_h = (Q_m/24) \times k_h = (0,9/24) \times 2,3 = 0,0863\ m^3$ / h = 86,3 l / h

k_h - coefficient of hourly unevenness (k_h = 1,8 - 2,3)

Annual water demand Q_r:

$Q_r = Q_d \times d$

$Q_r = 0,6 \times 350 = 210\ m^3/\ year$

d - number of operating days per year (365 days - 15 days of holiday)

- **Balance of hot water needs**

Average hot water demand Q_t:

$Q_t = q_t \times n$

$Q_t = 40 \times 6 = 240\ l\ /\ day = 0,24\ m^3/\ day$

q_t - specific daily hot water demand (q_t = 40 l / person × day)

- **Sewage outflow balance**

Average daily wastewater runoff Q_{ds}:

$Q_{ds} = q_s \times n$

$Q_{ds} = 100 \times 6 = 600\ l\ /day = 0,6\ m^3/\ day$

q_s - specific wastewater production according to ČSN 75 6402 (q_s = 100 l / person × day)

Maximum daily wastewater runoff Q_{ms}:

$Q_{ms} = Q_{ds} \times k_d$

k_d - daily unevenness coefficient (k_d = 1,25 - 1,5)

$Q_{ms} = 0,6 \times 1,5 = 0,9\ m^3/\ day = 900\ l\ /\ day$

Maximum hourly wastewater runoff Q_{hs}:

$Q_h = (Q_{ms} / t) \times k_h = (0,9/24) \times 8 = 0,3\ m^3/\ h = 300\ l\ /\ h$

k_h - coefficient of hourly unevenness (k_h for 6 persons = 8)

Annual wastewater runoff Q_{rs}:

$Q_{rs} = Q_{ds} \times d$

$Qr = 0,6 \times 350 = 210\ m^3/\ year$

d - number of operating days per year (365 days - 15 days of holiday)

- **Rainwater runoff balance**

Drainage areas:

Type of draining surface	A [m^2]	c	A_{red} [m^2]
Flat roof, with slope 2%	119,7	1,0	119,7

Where c - rainwater runoff coefficient (-)

A_{red} = 119,7 m^2

Annual rainfall runoff Q_{rd}:

$Q_{rd} = A_{red} \times h$

Q_{rd} = 119,7 × 0,607 = 72,66 m^3/year

A_{red} - Reduced area (m^2)

h - long-term rainfall for village Jinačovice (h = 607 mm)

Rainwater will be drained from the flat roof through roof outlets then by pipes to the retention tank and will continue to be drained to the drainage shaft then by the combined sanitary drainage connection to the public sanitary drainage system.

- **Heat loss calculation – using envelope method**

Heat loss calculations are specified in folder No.6 – calculations and building physics.

The building was classified to be in category B-economical, which satisfies Czech standards.

For heating and preparation of hot water I chose electric boiler Bosch Tronic Heat 3500 H – 18 FSE; and storage tank 120 liters, with maximal power 10 - 19,9 kW.

Gas line will be connected to the kitchen only.

- **Quantity and types of waste:**

The quantities and type of waste is assumed to be waste from household. Separation of garbage will be by using various types of containers located in the special area for garbage next to the gate.

Municipal waste: 6 persons × 5 liters / person / day = 30 liters / day

= 210 liters / week.

For the garbage separation 4 different containers will be used, each with volume 120 l , with supposed frequency of garbage removal once per 2 weeks.

i) Basic assumptions of construction - time data on construction realization, division into stages

The construction will not be divided into stages.

Estimated date of commencement of construction: 01/2021

Estimated completion date: 02/2022

j) Indicative construction costs

Total indicative cost is 6 560 000,-Kč

B.2.2 Overall urban and architectural design

a) Urban planning - territorial regulation, composition of spatial solution

The proposed detached house with translation office will be built in the village Jinačovice. The object is located 8,7 meters from the public sidewalk and main road, which is at the north border of the parcel. So there is a paved walkway in the parcel that leads directly from entrance gate of the parcel to entrance door of the house.

The house has two entrance doors, one entrance door leads to the entrance vestibule and is located on the north side of the house and second entrance door leads to the office and is located on the west side of the house.

Parking place is made of timber carport, it is separated from the building and located in the north east corner of the parcel directly near the main road, and it’s enough for two cars. From the parking place there is a paved sidewalk that leads to entrance doors.

The house is not in accordance with the zoning plan of the village of Jinačovice. The building is located on land intended to be garden so application must be submitted to obtain an exemption for the construction.

b) Architectural design - composition of shape design, material and color design

The building view from a plane looks like two rectangles of different size glued to each other. The small rectangle consists only of one floor, and serves only as entrance vestibule. The big rectangle consists of two floors and contains all other parts of the house. The house is covered with a flat roof which is insulated by mineral wool and is provided by outlets and roof hatch, which contains clear glass window for lighting and provides access to the roof. The frame of roof hatch is of stainless steel material.

Doors and windows in peripheral structure are plastic with triple glazing and have plastic frames with reinforcement. Internal doors are of timber material and timber frame. Colour of all doors and windows is golden oak.

Railing of staircase and balconies is made of stainless-steel material. Flashing products are of galvanized steel material. Specifications of design are provided in the list of flashing products and list of elements in folder No.3 – architectural structural solution.

The vertical load bearing masonry is made of ceramic Porotherm blocks. The horizontal load bearing structure is made of prestressed Spiroll ceiling panels. The building is insulated using ETICS system. The color of the facade is cream.

B.2.3 Overall operating solution, production technology

The main entrance door to the house is located on the north side, by this door family members can enter to the entrance vestibule which leads to the corridor No.1 then to the living room which has direction to the southeast. The living room is open to the kitchen which is located in the north east corner of the house.

In the living room there's a sliding door that leads to the staircase, also there is a door with safety fittings that leads to the corridor No.2, from which there are 3 doors, one door leads to the translation office which is located in the north west corner of the house, also there is a door that leads to the toilet No.2 which is connected with the technical and laundry room by a door, the

technical and laundry room is provided by a shower and located in the south-west part of the house and has door to the garden. The third door in the corridor leads to the understairs storage.

In the translation office there is one door that leads to the toilet No.1, which is a separated toilet that is used only by the business member.

The second entrance door is to the translation office, this entrance door is located on the west side of the building.

The staircase leads to the corridor No.3 in the second floor.

Corridor No.3 in the second floor has 5 doors. First door leads to first bedroom in the north east part of the house, second door leads to the second bedroom in the south east part of the house, third door leads to the third bedroom in the south west part of the house, fourth door leads to the toilet No.3 that is located on the west side, and the fifth door leads to the bathroom that is located in the north west side.

Both bedrooms in the south of the house are provided by balcony.

B.2.4 Barrier-free use of the building

Family house is not designed as barrier-free.

B.2.5 Safety in the use of the construction

The construction is designed and will be carried out so that it will comply with all valid decrees during the process of construction and use, (decree No. 591/2006 Coll. and 362/2005 Coll., on work safety and technical equipment during construction works).

B.2.6 Basic characteristics of objects

a) Building solutions

Vertical load bearing structure of the house is made of masonry ceramic blocks, Porotherm. The horizontal load bearing structure of the house is made of prefabricated prestressed Spiroll ceiling panels.

The house is covered by a flat roof that is insulated by mineral wools and provided by rain outlets and a roof hatch. The building is insulated using ETICS system with expanded polystyrene and extruded polystyrene as the insulating materials.

The building is constructed on plain concrete strip foundations.

Earthwork

Before excavation of the foundation stirps, the topsoil is removed at least 200 mm thickness. Excavations will be carried out mechanically, for example with a wheel excavator. Close to engineering networks it is necessary to dig manually with caution. The excavated soil will be stored on the building plot and then used to fill the building terrain.

Foundations and insulation

The design of the dimensions of strip foundations is specified in folder No.6 – calculations and building physics. The foundation strips and foundation slab will be made of cast-in-situ plain concrete of class C16 / 20. The foundation slab is designed with a thickness of 150 mm and contains Kari mesh under partitions.

For insulation of strip foundations polystyrene with reduced water absorption type XPS will surround the perimeter of foundations and peripheral walls up to 0,7 m above ground level and two layers of SBS modified bitumen felt with glass fiber base will be used as water proofing under the XPS along the side of strip foundations and the peripheral wall up to 0,7 m above ground level. Also two layers of SBS modified bitumen felt with glass fiber will be used to cover all the surface of foundation slab and it will go under masonry walls and pass down along the side of foundation strips.

b) Structural and material solutions

The peripheral load bearing masonry walls are made mainly of blocks Porotherm 44 dryfix, THK.= 440 mm, and also of blocks porotherm 30 profi dryfix, THK.= 300 mm. Inner load bearing masonry walls are made of Porotherm 30 profi dryfix, THK.= 300 mm. Partition walls are made of masonry Porotherm blocks 11,5 profi dryfix, THK.= 115 mm.

Horizontal load bearing structure of ceiling and of roof is made of prefabricated prestressed spiroll ceiling panels THK.= 200 mm.

The roof structure is designed as a flat roof with waterproofing of PVC-p plastic foil and thermal insulation of mineral wool. The roof is provided by rain outlets and roof hatch, which contains clear glass window for

lighting and provides access to the roof. Also Roof hatch is provided by extension ladder, that is possible to hang on the wall nearby when unused.

The bigger roof R1 is drained using keys of thermal insulation of mineral wool sloped 2% which drain rainwater into 2 roof outlets which are connected through vertical pipes with the rain drainage system which drain rainwater into retention tank then to the drainage shaft from which it's drained into combined drainage system.

The smaller roof R2 is drained using 2% sloped thermal insulation of mineral wool which drains rainwater into rain gutter and then into terrain.

Balconies are made of prefabricated reinforced concrete slab, concrete class C 25/30, and steel B500B, sloped 1% and are supported by load bearing element of Schöck isokrob T type K-O connected to the reinforced concrete ring.

The staircase is geometrical type made of prefabricated reinforced concrete, concrete class C 25/30, and steel B500B, covered by ceramic tiles, it connects first floor with second floor. More details about the design and calculations are provided in folder No.6 – calculations and building physics, and in folder No.3 – architectural structural solution.

The building is constructed on monolithic strip foundations of plain concrete C 16/20. Calculations of dimensions and loads are provided in the folder No.6 – calculations and building physics. Foundation slab contains Kari mesh under partitions.

The house is insulated by ETICS system which uses mainly expanded polystyrene EPS 100 F THK.= 100 mm as insulating material, and also extruded polystyrene XPS at the lower part of walls up to 0,7 m above ground level and around strip foundations. The outer reinforcing layer of ETICS system is made of adhesive gravel-putty with reinforcing fabric covered by the outer plaster which is made of mineral plaster.

Flooring is mostly of laminate type. Stone tiles will be used in bathrooms, toilets, and technical and laundry room.

Windows are plastic with triple glazing and plastic frame. Balcony doors and entrance doors are also plastic with triple glazing and reinforced

plastic frame. Internal doors are of timber. Roof hatch is with clear glass window and frame is made of stainless steel.

Flashing products are described in detail in folder No.3 – architectural structural solution.

c) Mechanical resistance and stability

The construction is designed to resist all mechanical loadings and to be stable. The foundation strip is designed in appropriate length to prevent frost effect in the soil.

B.2.7 Basic characteristics of technical and technological equipment

a) Technical solution

Water supply

New family house will be connected to water distribution system by a new water connection to the existing public water supply network. The new water connection will be routed from the existing public network to the water meter shaft in the parcel.

From the water meter shaft water pipes will be led to the house to the technical and laundry room and from there it will be heated and distributed throughout the building**.**

Sanitary drainage system

The building will be connected to the public combined drainage system. Connection will be led from the public combined drainage network to the drainage shaft on the parcel; and from there two connections will be constructed. First connection is to the retention shaft for drainage of rainwater from the roof and second connection is for drainage of sanitary wastewater from the house. All those connections will be led under foundations.

Rainwater drainage

Rainwater from flat roof R1 is drained by two outlets to vertical pipes which pass through the building down to under foundation slab and then by other pipes to under foundation strips then it will be drained to the retention tank, from retention tank rainwater will be drained to the drainage shaft then into combined drainage system**.**

Heating

Family house will be heated by electric boiler, which will be located in the technical and laundry room. The heat will be distributed by Korado classic plates radiators. Other heat source is the fire place in the living room.

Storage tanks for heating system will be also located in the technical and laundry room. All equipments for heating will be designed by a heating expert.

Gas distribution

The new house will also be connected to the gas pipeline of low pressure. The gas connection from the public gas line will be led to a gas meter with main gas closing valve located at the north border of the parcel, then gas pipes will be led to the kitchen. Gas will be connected to the cooker only.

Ventilation

The object will be ventilated naturally through windows. Forced ventilation will be used in the kitchen in 1st floor by an air extractor. Ventilation tubes of air extractor will pass through the peripheral wall to the outside.

Electrical energy

The house will be connected to the public electric power network, a connection from electric switchboards on the border of the parcel will be led to the kitchen, and from there electricity will be distributed throughout the whole house.

Lightning conductor

Lightning protection according to requirements of ČSN EN 62305-1,2,3,4,5.

b) A list of technical and technological equipment

The list of technical and technological equipment is not a part of the bachelor thesis.

B.2.8 Principles of fire safety solution

The solution is elaborated in a separate part in folder No.5 - Fire safety solution. The building belongs to the group OB1. The structural system is

evaluated as non-combustible. The building is divided into 1 fire compartment.

The building is provided by two autonomous detection and signaling detectors, one in each floor. In addition to that one portable powder fire extinguisher will be placed in first floor of the house.

B.2.9 Energy saving and thermal protection

The house is designed to be nearly zero energy building and is in accordance with the valid legislation ČSN 73 0540-2: 2010. It's designed to meet recommended values of heat transfer coefficients which is calculated in details in the technical thermal and heat loss assessment of the house in folder No.6 – calculations and building physics.

On the basis of this assessment the building was classified into category B-economical, which satisfies Czech standards.

B.2.10 Hygienic requirements for buildings, requirements for working and communal environment. Principles of solving construction parameters (ventilation, heating, lighting, water supply, waste etc.) and the principles of solving the impact of construction on the environment (vibration, noise, dust, etc.)

Water supply

New family house will be connected to water distribution system by a new water connection to the existing public water supply network. The new water connection will be routed from the existing public network to the water meter shaft in the parcel.

From the water meter shaft water pipes will be led to the house to the technical and laundry room and from there it will be distributed throughout the building**.**

Sanitary drainage system

The building will be connected to the public combined drainage system. Connection will be led from the public combined drainage network to the drainage shaft on the parcel; and from there two connections will be constructed. First connection is to the retention shaft for drainage of rainwater from the roof and second connection is for drainage of sanitary

wastewater from the house. All those connections will be led under foundations.

Rainwater drainage

Rainwater from flat roof R1 is drained by two outlets to vertical pipes which pass through the building down to under foundation slab and then by other pipes to under foundation strips then it will be drained to the retention tank, from retention tank rainwater will be drained to the drainage shaft and then into combined drainage system**.**

Heating

Family house will be heated by electric boiler, which will be located in the technical and laundry room. The heat will be distributed by Korado classic plates radiators. Other heat source is the fire place in the living room.

Storage tanks for heating system will be also located in the technical and laundry room. All equipments for heating will be designed by a heating expert.

Gas distribution

The new house will also be connected to the gas pipeline of low pressure. The gas connection from the public gas line will be led to a gas meter with main gas closing valve located at the north border of the parcel, then gas pipes will be led to the kitchen. Gas will be connected to the cooker only.

Ventilation

The object will be ventilated naturally through windows. Forced ventilation will be used in the kitchen in 1st floor by an air extractor. Ventilation tubes of air extractor will pass through the peripheral wall to the outside.

Electrical energy

The house will be connected to the public electric power network, a connection from electric switchboards on the border of the parcel will be led to the kitchen, and from there electricity will be distributed throughout the whole house.

Waste

There will be four garbage bins on the parcel for separation of household waste, which will be regularly transported by a specialized company to waste disposal.

Vibration and dustiness

The assessment of air and impact sound insulation is provided in folder No.6 – calculations and building physics. In the object there's not significant sources of noise, vibration and dust. At the same time the object itself is adequately protected against noise and vibration.

The object will not affect its surrounding in terms of noise and dust.

Solution of the influence of the building on the surroundings

The proposed building has minimal impact on its surrounding. This is a family house for six members, with a small translation office for one of the family members. For this reason, there is no anticipated increased noise level or vibration.

The object will not be a source of harmful emissions. So the building will not have on the surroundings any negative impact.

B.2.11 Principles of building protection against negative effects of the external environment

a) Protection against penetration of radon from the subsoil

The radon incidence index is low in this area.

b) Protection against stray currents

It's not a part of the bachelor thesis.

c) Protection against technical seismicity

The object is not in a seismic area.

d) Noise protection

In the surroundings there is no source of noise from which it would be necessary to protect the building.

e) Flood control measures

There is no need to address flood control measures, the building is not located in the flood area.

f) Other effects - undermining effects, methane occurrence, etc.

It’s not found.

B.3 Connection to technical infrastructure

a) Connection points of technical infrastructure

New family house will be connected to water distribution system by a new water connection to the existing public water supply. The new water connection will be routed from the existing public network to the water meter shaft in the parcel. From the water meter shaft water pipes will be led to the house to the technical and laundry room and from there it will be distributed throughout the building.

The building will be connected to the public combined drainage system. Connection will be led from the public combined drainage network to the drainage shaft on the parcel; and from there two connections will be constructed. First connection is to the retention shaft for drainage of rainwater from the roof and second connection is for drainage of sanitary wastewater from the house. All those connections will be led under foundations.

Rainwater from flat roof R1 is drained by two outlets to vertical pipes which pass through the building down to under foundation slab and then by other pipes to under foundation strips then it will be drained to the retention tank, from retention tank rainwater will be drained to the drainage shaft and then into combined drainage system.

The new house will also be connected to the gas pipeline of low pressure. The gas connection from the public gas line will be led to a gas meter with main gas closing valve located at the north border of the parcel, then gas pipes will be led to the kitchen. Gas will be connected to the cooker only.

The house will be connected to the public electric power network, a connection from electric switchboards on the border of the parcel will be led to the kitchen, and from there electricity will be distributed throughout the whole house.

b) connection dimensions, power capacities and lengths

Connecting dimensions, power capacities and lengths are not a subject of the bachelor thesis.

B.4 Transport solutions

a) A description of the transport solution, including barrier-free measures for accessibility and use of the building by persons with reduced mobility

The new house is located 8,7 meters from the main road, which is at the north border of the parcel. So there is a paved walkway in the parcel that leads directly from entrance gate at the public sidewalk to entrance door of the house.

b) Connecting the territory to the existing transport infrastructure

At the north border of the parcel is the entrance gate which is located directly at the public sidewalk and main road. From the entrance gate of the parcel a paved walkway with concrete tiles will be made to connect entrance gate of the parcel with entrance door of the house.

c) Traffic at rest

On the parcel there will be a parking place for two cars under a timber carport.

d) walking and cycling trails.

Walking and cycling trails don’t exist near the new house.

B.5 Solution of vegetation and related landscaping

a) Landscaping

Before the excavation work, the topsoil will be removed with thickness of at least 200 mm. Subsequent excavated soil will be stored on the building parcel, then used to fill the building terrain.

b) The vegetation elements used

Most of the land will be covered with lawn, also along the borders of the parcel conifer trees will be planted.

c) Biotechnology measures

Biotechnology measures are not needed.

B.6 Description of the environmental impacts of the building and its protection

a) Environmental impact - air, noise, water, waste and soil

The construction will not adversely affect the environment. It will not create excessive noise or waste. Rainwater will be collected by the retention tank. Waste will be collected and separated into garbage containers.

b) Impact on nature and landscape - protection of tree species, protection of memorial trees, protection of plants and animals, preservation of ecological functions and links in the landscape, etc...

There are no memorial trees, plants or animals on the plot. The building is not in the protection zone.

c) Impact on the Natura 2000 network of protected areas

The parcel is not found on a protected area Natura 2000.

d) The manner of taking into account the conditions of the binding opinion of the environmental impact assessment of the project, if it is the basis.

All environmental requirements will be met.

e) In the case of projects falling within the regime of the Act on Integrated Prevention, the basic parameters of the method of fulfilling the conclusions on best available techniques or the integrated permit, if issued

It does not fall under the integrated prevention Act.

f) The proposed protection and safety zones, the scope of the restrictions and the conditions of protection under other legislation

No protective or safety zones are proposed for this construction.

B.7 Population protection

For this project documentation there are no other requirements in terms of fulfillment of the tasks of population protection.

B.8 Principles of construction organization

a) The needs and consumption of critical media and materials, their provision

For the construction it will be necessary to provide electric current and sufficient amount of water. Water will be provided by a temporary connection and electricity will be provided from the switchboard. Connections shall be established before construction starts. During the construction it is necessary to ensure continuous supply of construction material to the building. Material storage areas will be on the building plot.

b) Drainage of construction sites

No special drainage of the construction site is necessary. Precipitation will be spontaneously seeped into the terrain. Only if rainwater accumulates in the foundation strips, it must be drained.

c) Connection of the construction site to the existing transport and technical infrastructure

Entrance to the site will be made at the north side of the parcel. The construction site will be connected to the existing engineering networks. Land will be fenced and equipped with a lockable gate.

d) Effect of construction on surrounding buildings and land

No chemical or toxic substances will be produced during construction. Some steps will be taken to reduce dustiness. Hygiene regulations will be observed during construction.

e) Protection of the surroundings of the construction site and requirements for related sanitation, demolition, felling of trees

The site will be fenced and marked with signs prohibiting unauthorized persons from entering the site. This will prevent the possibility of injuries and

health risks to unauthorized public people. The construction does not require felling of trees. Waste will be disposed properly.

f) Maximum temporary and permanent occupations of construction sites

No permanent occupations are considered. All the materials will be stored and added to the construction gradually.

g) Requirements for barrier-free bypass routes

Requirements for barrier-free bypass routes are not required.

h) Maximum amounts and types of waste and emissions generated during construction, their disposal

Waste must be treated in accordance with Act No. 185/2001 Coll.

i) Earthwork balance, soil inflow or storage requirements

Topsoil will be removed with a minimum thickness of 200 mm. Further earthworks will be carried out for digging of the foundations. All excavated soil and removed topsoil will be stored on building plot and will be used after construction for levelling of the terrain.

j) Protection of the environment during construction

During construction, there will be increased dust and noise in the surrounding. General conditions for environmental protection will be respected. Construction waste must be disposed in accordance with the Waste Act No. 185/2001 Coll and public notice 93/2016, waste catalogue.

In addition, it is necessary that the construction activities are in accordance with the protection of existing greenery according to ČSN 83 9011 Working with soil and ČSN 83 9061 Protection of trees, vegetation and vegetation areas during construction work.

k) The principles of occupational safety and health at the construction site

Safety of work at the construction site must be followed by public notice No. 591/2006 Coll. on minimum requirements for occupational and health and safety at the construction site and also by act No.309/2006 about health and safety. Furthermore, it is necessary to comply with Act No.378/2001 Coll.

safety of operated machinery and also Act No. 362/2005 Coll. on more detailed health and safety requirements at workplaces with the risk of falling from a height or depth.

l) Adaptations for barrier-free use by construction of the constructions concerned

Due to the nature of the building and the requirements of the investor, it is not necessary to solve its use by persons with reduced mobility.

m) Principles for traffic engineering measures

No traffic engineering measures are required. A sign indicating the exit of vehicles from the construction site will be placed in front of the entrance gate to the construction site.

n) Determination of special conditions for the execution of construction - execution of construction during operation, measures against the effects of the external environment during construction, etc.

It is not necessary to set special conditions for the construction of this new building. Construction work will not occur during night.

o) Progress of construction, decisive partial deadlines

Estimated start date of construction: 01/2021. Estimated end date of construction: 02/2022. List of decisive deadlines:

- when handing over the construction site
- foundation strips and foundation slab
- peripheral walls
- ceiling
- roof
- final inspection at the handover of the construction and before the application for the final building approval.

B.9 Overall water management solution

The new detached house will be connected to the water distribution system by a new water connection to the existing public water supply system. The new water connection will be led from the existing public network to the plot to the

water meter shaft. From the water meter shaft the water connection will be led to the house to the technical and laundry room and from there it will be distributed throughout the building.

The building will be connected to the public combined drainage system. Connection will be led from the public combined drainage network to the drainage shaft on the parcel, and from there two connections will be constructed. First connection is to the retention shaft for drainage of rainwater from the roof and second connection is for drainage of sanitary wastewater from the house. All those connections will be led under foundations.

Rainwater from the flat roof is drained by two outlets into vertical pipes which pass through the building down to under foundation slab and then by other pipes under foundation strips to the retention tank, from retention tank rainwater will be drained to the drainage shaft**.**

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ÚSTAV POZEMNÍHO STAVITELSTVÍ

DETACHED HOUSE
RODINNÝ DŮM

C. SITUATION DRAWINGS

BACHELOR'S THESIS
BAKALÁŘSKÁ PRÁCE

AUTHOR — Nour Kováčová
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VEDOUCÍ PRÁCE

BRNO 2020

C. SITUATION DRAWINGS

C.1 Situation drawing of wider relationships

a) 1: 1000 to 1: 50000 scale

b) connection of the building to transport and technical infrastructure

c) existing and proposed protection and safety zones

d) an indication of the borders of the territory concerned

C.2 Cadastral situation drawing

a) scale according to the cadastral map used

b) drawing of the proposed building

c) an indication of the links and effects on the environment

C.3 Coordinating situation drawing

a) scale 1: 200 to 1: 1000, for large buildings 1: 2000 or 1: 5000, for a change of a building that is a cultural monument, for a building in a conservation area or a monument zone at a scale of 1: 200

b) existing buildings, transport and technical infrastructure

c) land boundaries, parcel numbers

d) the boundaries of the area concerned

e) existing altimetry and planimetry

f) designation of individual designed and removed buildings and technical infrastructure

g) determination of the elevation of the above-ground storeys for buildings (± 0,00) and the height of the terrain; maximum height of buildings

h) proposed roads and paved areas, connection to transport infrastructure

i) vegetation management

j) dimensioned distances of buildings

k) drawing of new technical infrastructure, connection of construction to technical infrastructure

l) existing and proposed protection and security zones, conservation areas, conservation zones, etc.

m) maximum temporary and permanent occupations

n) designation of geotechnical probes

o) geodetic data, determination of the setting grid coordinates

p) construction site equipment with an entry mark

q) separation distances, including delimitation of fire hazard areas, access roads and access areas for fire fighting equipment and sources of fire water.

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D. DOCUMENTATION OF OBJECTS AND TECHNICAL AND TECHNOLOGICAL EQUIPMENTS

BACHELOR'S THESIS

BAKALÁŘSKÁ PRÁCE

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D. DOCUMENTATION OF OBJECTS AND TECHNICAL AND TECHNOLOGICAL EQUIPMENTS

D.1 Documentation of building or engineering object

D.1.1 Architectural and construction solutions

a) Technical report

Purpose of the object, function, capacity data

The building will be used as a house for a family of six members with one office that is meant to be translation office.

Total parcel area: 1 256 m2

Built-up area: 128,691 m2

Enclosed space: 867,456 m3

Usable area: 197,88 m2

Number of functional units: 1

Number of house users: 6

Number of business users: 1

Architectural, visual and material solutions

The building view from a plane looks like two rectangles of different size glued to each other. The small rectangle consists only of one floor, and serves only as entrance vestibule. The big rectangle consists of two floors and contains all other parts of the house. The house is covered with a flat roof which is insulated by mineral wool and is provided by outlets and roof hatch, which contains clear glass window for lighting and provides access to the roof. The frame of the roof hatch is of stainless steel material.

Doors and windows in peripheral structure are plastic with triple glazing and have plastic frames with reinforcement. Internal doors are of

timber material and timber frame. Colour of all doors and windows is golden oak.

Railing of staircase and balconies is made of stainless-steel material. Flashing products are of galvanized steel material. Specifications of design are provided in the list of flashing products and list of elements in folder No.3 – architectural structural solution

The vertical load bearing masonry is made of ceramic Porotherm blocks. The horizontal load bearing structure is made of prestressed Spiroll ceiling panels. The building is insulated using ETICS system. The color of the facade is cream.

Layout solution

The main entrance door to the house is located on the north side, by this door family members can enter to the entrance vestibule which leads to the corridor No.1 then to the living room which has direction to the southeast. The living room is open to the kitchen which is located in the north east corner of the house.

In the living room there's a sliding door leading to the staircase, also there is a door with safety fittings that leads to the corridor No.2, from which there are 3 doors, one door leads to the translation office which is located in the north west corner of the house, also there is a door that leads to the toilet No.2 which is connected with the technical and laundry room by a door, the technical and laundry room is provided by a shower and located in the south-west part of the house and has door to the garden. The third door in the corridor leads to the understairs storage.

In the translation office there is one door that leads to the toilet No.1, which is a separated toilet that is used only by the business member.

The second entrance door is for the translation office, this entrance door is located on the west side of the building.

The staircase leads to the corridor No.3 in the second floor.

Corridor No.3 in second floor has 5 doors. First door leads to first bedroom in the north east part of the house, second door leads to the second bedroom in the south east part of the house, third door leads to the third

bedroom in the south west part of the house, fourth door leads to the toilet No.3 that is located on the west side, and the fifth door leads to the bathroom that is located in the north west side.

Both bedrooms in the south of the house are provided by balcony.

Barrier-free arrangement of the construction

Family house is not designed as a barrier-free building and is not suitable for use by persons with reduced mobility.

Structural and constructional technical solution and technical properties of the building

The peripheral load bearing masonry walls are made mainly of blocks Porotherm 44 profi dryfix, THK.= 440 mm, and also of blocks Porotherm 30 profi dryfix, THK.= 300 mm. Inner load bearing masonry walls are made of Porotherm 30 profi dryfix, THK.= 300 mm. Partition walls are made of masonry Porotherm blocks 11,5 profi dryfix, THK.= 115 mm.

Horizontal load bearing structure of ceiling and of roof is made of prefabricated prestressed spiroll ceiling panels THK.= 200 mm.

The roof structure is designed as a flat roof with waterproofing of PVC-p plastic foil and thermal insulation of mineral wool. The roof is provided by rain outlets and roof hatch, which contains clear glass window for lighting and provides access to the roof. Also Roof hatch is provided by extension ladder, that is possible to hang on the wall nearby when unused.

The bigger roof R1 is drained using keys of thermal insulation of mineral wool sloped 2% which drain water into 2 roof outlets which are connected through vertical pipes with the rain drainage system which drain rainwater to the combined drainage system.

The smaller roof R2 is drained using 2% sloped thermal insulation of mineral wool which drains rainwater into rain gutter and then into terrain.

Balconies are made of prefabricated reinforced concrete slab, sloped 1% and are supported by load bearing element of Schöck isokrob T type K-O connected to the reinforced concrete ring.

Building physics - thermal engineering, lighting, sunlight

Calculations of heat transfer coefficient, heat loss, daylight factor, and air and impact sound insulation are provided in folder No.6 – calculations and building physics.

b) Drawing part

It's provided in attachments in folder No.3 - Architectural structural solution and in folder No.4 - Building construction solution.

D.1.2 Structural solution

a) Technical report

Earthwork

Building plot is located on a slightly sloping terrain, which was already levelled before the start of the construction. The hydrogeological and geological survey was not implemented. Before excavation of the foundation stirps, the topsoil will be removed with at least 200 mm thickness. Excavation will be carried out mechanically, for example with a wheel excavator, but close to engineering networks it is necessary to dig manually with caution. The excavated soil will be stored on the building plot and then used to fill the building terrain. Concrete C 16/20 will be used for strip foundations and foundation slab.

Foundation construction

The design and calculations of the dimensions of strip foundations and loads are specified in folder No.6 – calculations and building physics. The foundation strips and foundation slab will be made of cast-in-situ plain concrete of class C16 / 20. The foundation slab is designed with a thickness of 150 mm and contains Kari mesh under partitions.

For insulation of strip foundations polystyrene with reduced water absorption type XPS will surround the perimeter of foundations and peripheral walls up to 0,7 m above ground level and two layers of SBS modified bitumen felt with glass fiber base will be used as water proofing under the XPS along the side of strip foundations and the peripheral wall up to 0,7 m above ground level. Also two layers of SBS modified bitumen felt with glass fiber will be used to cover all the surface of foundation slab and

it will go under masonry walls and pass down along the side of foundation strips.

Waterproofing, measures against radon, vapor-proof foil

The main waterproofing of the structure will be carried out using two layers of SBS modified bitumen felts. First, penetrating primer of asphalt emulsion must be applied on the top of oversite concrete.

After the penetrating primer has dried, the first bitumen felt with fiber glass base is applied by melting in spots. The second bitumen felt with lining from polyester mat will be melted all over.

Both bitumen felts will be also applied vertically along the side of strip foundations, the side of foundation slab and peripheral wall up to 0,7 m above ground level.

Bitumen felts on vertical side will be protected by thermal insulation of extruded polystyrene XPS THK.= 100 mm and studded draining foil under the soil.

The main waterproofing layer of the flat roof will be PVC-P foil.

The main vapor barrier on the flat roof will be made of SBS-modified bitumen felt with supporting aluminium foil and fiberglass applied by melting on a dried coat of penetrating primer.

Vertical construction

The peripheral load bearing masonry walls are made mainly of blocks Porotherm 44 profi dryfix, THK.= 440 mm, and also of blocks porotherm 30 profi dryfix, THK.= 300 mm. Inner load bearing masonry walls are made of Porotherm 30 profi dryfix, THK.= 300 mm. Partition walls are made of masonry Porotherm blocks 11,5 profi dryfix, THK.= 115 mm.

Horizontal structures

Horizontal load bearing structure of ceiling and of roof is made of prefabricated prestressed spiroll ceiling panels THK.= 200 mm.

Balconies are made of prefabricated reinforced concrete slab, concrete class C 25/30, and steel B500B, sloped 1% and are supported by load bearing element of Schöck isokrob T type K-O connected to the reinforced concrete ring.

Staircase design

The staircase is geometrical type made of prefabricated reinforced concrete, concrete class C 25/30, and steel B500B, covered by ceramic tiles, it connects first floor with second floor. More details about the design is provided in folder No.6 – Calculations and building physics, and in folder No.3 – architectural structural solution

Lintels

Ceramic reinforced lintels above all openings will be used. They will be from the same company Porotherm and same system. Lintels above openings in the load bearing walls will be made of lintel KP7.

Lintels above openings in internal non-load bearing walls will be made of lintel KP 11,5.

Rings

Rings design is specified in the drawings of ceiling in folder No.4 building construction solution and are made of reinforced concrete, concrete class C 25/30, and steel B500B.

Roof construction

The roof structure is designed as a flat roof with waterproofing of PVC-p plastic foil and thermal insulation of mineral wool.

The roof is provided by roof hatch, which contains clear glass window for lighting and provides access to the roof. Also Roof hatch is provided by extension ladder, that is possible to hang on the wall nearby when unused.

The bigger roof R1 is drained using keys of thermal insulation of mineral wool sloped 2% which drain water into 2 roof outlets which are connected through vertical pipes with the rain drainage system which drain rainwater into the retention tank then to combined drainage system.

The smaller roof R2 is drained using 2% sloped thermal insulation of mineral wool which drains rainwater into rain gutter and then into terrain.

The main vapor barrier on the flat roof will be made of SBS-modified bitumen felt with supporting aluminium foil and fiberglass applied by melting on a dried coat of penetrating primer.

After applying vapor barrier a sloping layer of mineral wool type SD is laid on which is also laid another two layers of thermal insulation of mineral wools type R and S which are protected by geotextile of polypropylene on the top, upon which is applied waterproofing of PVC-p plastic foil which is mechanically anchored and overlaps are melted by hot air.

Floor structures

Flooring is mostly of laminate type. Stone tiles will be used in bathrooms, toilets, and technical and laundry room.

Openings filling

All interior doors in the house are designed as timber hinged doors, partially glazed by opaque glazing except doors of bathrooms, toilets, technical and laundry room and understair-storage, where doors are not glazed at all. Another exception is the door connecting the living room with the staircase which is plastic folding door with partial opaque glazing. And also the door that is in the toilet No.1 (the office toilet) is also plastic folding door.

All interior doors have timber frames except the door connecting the living room with corridor No.2 which has steel frame.

Doors and windows that are in peripheral structure are all plastic with reinforced plastic frames and triple safety glazing, they differ in design.

Roof hatch is with clear glass window and the frame is made of stainless steel. All specifications about the design of doors and windows are provided in folder No.3 – architectural structural design, in the list of elements.

Surface finishes

Internal plaster

At the beginning of work and before plastering, the transition points of materials must be treated by penetrating coat and reinforced by mesh and adhesive. At corners, edges and at the openings in contact with windows and doors frames finishing profiles APU with mesh must be used.

The internal plaster will be lime-cement core plaster which will be first applied and then after it dries a layer of fine stucco plaster will be applied. After both layers dry, they will be painted with a vapor-permeable paint.

In rooms such as toilets, bathrooms, technical and laundry room, ceramic tiles will be used to a specific height that is specified in the plan drawings then same interior plaster will be applied on the walls and ceilings.

External plaster

The building is insulated using ETICS system. Two types of outer plaster is used. First type is for the house plinth up to 0,7 m above ground level, this plaster is composed of outer layer of elastomeric plaster CT 79, smooth structure, grain 1,5, THK.= 3 mm, and inner layer of adhesive gravel putty ceresit ct 80 with reinforcing fabric vertex R 131. THK.= 3 mm.

Second type is used on peripheral walls. This plaster is composed of outer layer of mineral plaster ceresit ct 137, THK.= 3 mm, and inner layer of adhesive gravel putty ceresit ct 80 with reinforcing fabric vertex R 131, THK.= 3 mm.

Joinery products

All carpentry products such as interior doors are specified in the list of elements in folder No.3 – architectural structural solution. Some other joinery products such as closets will be used, and their design is according to investor.

Flashing products

Flashing products are made of galvanized steel sheet and are specified in the list of flashing products in folder No.3 – architectural structural solution.

Other products

Stainless steel railings for staircase and for balconies will be used. Design details are specified in the list of elements in folder No.3 – architectural structural solution.

Chimney is of type Schiedel Absolut D = 180 mm, outer dimensions 360/360 mm, and it’s separated from the wall by dilatation joint of mineral wool THK.= 10 mm.

Air extractor is of type CATA EMPIRE KD 312050, width = 50 cm, of Stainless steel material, with maximum power 297 m³ / h (15 Pa), and 3 speeds. It's connected to ventilation pipe of diameter = 100 mm, with insulation of type IZO100/500 KP around it THK.= 50 mm.

Paved areas

The upper surface of the paved surfaces will be made of a concrete tiles on a layer of gravel-sand bed with curbs on outer sides.

b) Drawing part

Drawings are provided in folder No.3 - Architectural structural solution and in folder No.4 - Building construction solution.

c) Static assessment

Static calculations of loads, foundation structures and staircase are provided in folder No.6 – calculations and building physics.

D.1.3. Fire safety solutions

The fire safety solution of the building is provided in folder No.5 - Fire safety solutions.

3. CONCLUSION

The subject of this bachelor thesis is to design and prepare project documentation of a house for 6 family members, with a translation office for one of the family members.

The parcel of the construction is situated in village Jinačovice in the south Moravian region of the Czech Republic.

The house is designed to be nearly zero energy building and to meet all Czech technical requirements of standards, decrees, regulations and technical sheets of manufacturers.

I tried to design the building so that it has the best orientation possible. By processing this work and professional consultations, I gained a lot of valuable advices and experience.

4. LIST OF SOURCES USED

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5. LIST OF ABBREVIATIONS AND SYMBOLS USED

1st	First
2nd	Second
R.C.	Reinforced concrete
PE	Polyethylene
RT	Retention tank
HUP	Main gas closing valve
DSH	Drainage shaft
WM	Water meter
F.G.L	Formation ground level
PVC	Polyvinylchloride
PE	Polyethylene
XPS	Extruded polystyrene
SBS	Styrene Butadiene Styrene
THK.	Thickness
R	Thermal resistance of the structure
H_T	Specific heat loss by heat penetration
U	Heat transfer coefficient
U_{em}	Average heat transfer coefficient
λ	Coefficient of thermal conductivity
DN	Diameter
D.	Diameter
EPS	Expanded polystyrene
XPS	Extruded polystyrene
DN	Diameter
ČSN	Czechoslovak standards
NTL	Low gas pressure

W.	Width
H.	Height
PU	Polyurethane foam
SC	Scale
L.	Length
AL	Aluminium
No.	Number
SYM	Symbol
μ	Diffusion factor
F.G.L.	Formation ground level
m.a.s.l.	Meter above sea level

6. LIST OF ATTACHMENTS

FOLDER No.1 – PREPARATORY AND STUDY WOR

S.01	STUDY OF 1ST FLOOR PLAN	SC 1:100 2 x A4
S.02	STUDY OF 2ND FLOOR PLAN	SC 1:100 2 x A4
S.03	STUDY OF SECTION A-A'	SC 1:100 2 x A4

FOLDER No.2 – SITUATION DRAWINGS

C.1	SITUATION DRAWING OF WIDER RELATIONSHIP	2 x A4
C.2	CADASTRAL SITUATION DRAWING	SC 1:200 4 x A4
C.3	COORDINATION SITUATION DRAWING	SC 1:200 4 x A4

FOLDER No.3 – ARCHITECTURAL STRUCTURAL SOLUTION

D.1.1.1	1ST FLOOR PLAN	SC 1:50 8 x A4
D.1.1.2	2ND FLOOR PLAN	SC 1:50 8 x A4
D.1.1.3	SECTION A-A'	SC 1:50 8 x A4
D.1.1.4	SECTION B-B'	SC 1:50 8 x A4
D.1.1.5	NORTH AND SOUTH VIEWS	SC 1:50 8 x A4
D.1.1.6	EAST AND WEST VIEW	SC 1:50 8 x A4
D.1.1.7	DETAIL A AND B OF ATTIC AND ROOF OUTLET	SC 1:10 4 x A4
D.1.1.8	DETAIL C OF BALCONY	SC 1:5 8 x A4
D.1.1.9	DETAIL D OF HOUSE PLINTH	SC 1:10 4 x A4
D.1.1.10	DETAIL E AND F OF ROOF-WALL CORNER AND RAIN GUTTER	SC 1:5 8 x A4

D.1.1.11	COMPOSITIONS OF THE STRUCTURE	10 x A4
D.1.1.12	FLASHING PRODUCTS	3 x A4
D.1.1.13	LIST OF ELEMENTS	12 x A4

FOLDER No.4 – BUILDING CONSTRUCTION SOLUTION

D.1.2.1	FOUNDATIONS DRAWING	SC 1:50 8 x A4
D.1.2.2	CEILING ABOVE 1ST FLOOR	SC 1:50 8 x A4
D.1.2.3	CEILING ABOVE 2ND FLOOR	SC 1:50 8 x A4
D.1.2.4	FLAT ROOF DRAWING	SC 1:50 8 x A4
D.1.2.5	3D MODEL OF LOAD BEARING SYSTEM	6 x A4
D.1.2.6	MODULAR MASONRY BONDING OF PERIPHERAL WALLS IN 1ST FLOOR	SC 1:50 8 x A4
D.1.2.7	MODULAR MASONRY BONDING OF PERIPHERAL WALLS IN 2ND FLOOR	SC 1:50 8 x A4

FOLDER No.5 – FIRE SAFETY SOLUTION

D.1.3.1	TECHNICAL REPORT OF FIRE SAFETY	8 x A4
D.1.3.2	1ND FLOOR PLAN	SC 1:50 8 x A4
D.1.3.3	2ND FLOOR PLAN	SC 1:50 8 x A4
D.1.3.4	SITUATION DRAWING	SC 1:200 4 x A4

FOLDER No.6 – CALCULATIONS AND BUILDING PHYSICS

ACOUSTICS	6 x A4
DAYLIGHT FACTOR ASSESSMENT	10 x A4
FOUNDATIONS AND LOAD CALCULATIONS	9 x A4

STAIRCASE CALCULATIONS	2 x A4
TECHNICAL THERMAL AND HEAT LOSS ASSESSMENT	16 x A4

FOLDER No.7 – VISUALIZATION

VISUALIZATION	20 x A4